CONFIDENTIAL

CAMBRIDGE

TO: H. C. Duecker

DATE: February 26, 1976

FROM: J. C. Yang

SUBJECT: Tremolite Fiber Removal from Libby Vermiculite

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PURPOSE

The purpose of this study is to seek a feasible method of separation and subsequent removal of tremolite fibers from vermiculite ore.

BACKGROUND INFORMATION

Based on previous work on density studies of vermiculites and tremolites, an appreciable difference between the densities of vermiculites (2.28 to 2.61 depending upon the degree of weathering) and tremolites (2.93 3.01). The two groups of substances should be easily separable.

Microscopic examination of the vermiculite plates showed very dusty surface with either small vermiculite particles or small fibers adhering to them (Figure 1a). The residual amine and/or hydrocarbon from the flotation process form a thin film on the surface of the vermiculite platlets which may bind the small particles or electrostatic may contribute to the phenomenon.

EXPERIMENTAL

Attempts were made using various organic solvents to rework the traces of amine or hydrocarbon but these were not successful. When the vermiculite plates were dried, the film remained.

Ideas were then conceived to use air elutriation techniques for separation since the specific gravities and the morphology of vermiculite and tremolite are very different.

A simple 30" glass column was set up which has a narrow opening at the bottom and was connected with the compressed air line to simulate a turbulent fluidized bed.

In the column, a heavy metal grid was placed as a support on which a fine 100 mesh copper screen was placed as shown in the diagram (Figure 2). When a moderate air pressure was applied, a fine dust cloud could be seen from the top of the column. The top 325 stainless screen served as a barrier, preventing the large platlets to fly out. One could observe quickly that only the vermiculite platlets were floating in the middle of the glass column when the air pressure was adjusted. Rocks, vermiculite aggregates and fiber bundles were concentrated on the bottom.

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When the top cover screen was examined microscopically, a large number of fine vermiculite particles and numerous fine fibers could be seen on the pores of the screen as shown in Figure 3.

The air floated vermiculite platlets were then collected and a visible color difference from the original material was noted. All the surfaces of the air elutriated vermiculite were "polished" in the air stream with very little dust remaining on the surface. A comparison of the vermiculite surfaces before and after air elutriation treatment is shown in Figure 1, photomicrographs 1a and 1b. The air "polished" vermiculite flakes were transferred to a second air elutriation column and the experiment was repeated. The top covering screen was then examined microscopically and compared with the findings from the previous run. Only very few vermiculite dust particles were observed in most of the typical fields under the microscope as shown in Figure 4a, and an occasional field with some fiber as shown in Figure 4b. The loading on the screen from the second run was very light in comparison with the first run (Figure 3).

OBSERVATIONS and DISCUSSION

1. From the photomicrographs and the laboratory column test, it is demonstrated that tremolite fibers, vermiculite dusts, unexpandable vermiculite aggregates, rocks and tremolite fiber bundles can be removed from the vermiculite flakes to a great extent by air elutriation technique.

2. The fine fibers and vermiculite dusts are lighter than vermiculite which can be removed and collected on the top of the column whereas the rocks, unexpandable vermiculite aggregates and tremolite bundles can be concentrated on the bottom. With the three zone separation as shown in Figure 3, an estimate of 80-90% of the tremolite and other impurities from Libby #2 end product by this treatment.

3. When the "polished" vermiculite collected from the first column and subject to a second column or a series of columns, the material will be further purified.

4. Presently we have only worked with Libby #2 composite, since a previous study (Libby Ore Evaluation - Ore Impurities 2/23/76) showed #2 has the highest tremolite content of around 5%. For smaller sizes a fairly efficient removal of impurities is expected but probably not as spectacular as #2.

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RECOMMENDATIONS

1. A pilot plant scale air elutriation column should be designed and built to test the validity of the proposed method. It is recommended to introduce the compressed air stream from a side arm and design collecting devices for three zones to separate the vermiculite from others.

2. Different grades of end products should be tried in the pilot plant scale equipment, and the tremolite content of each fraction should be determined by either quantitative x-ray method or expansion-flotation methods.

3. If the method proves to be effective, we may be able to remove the bulk of the loose fiber impurities from vermiculite at the source, reducing the need for critical control set-ups and problems at each individual expansion plant or field application.

4. An invention record is being written for protecting any novel applications of the method for tremolite removal from vermiculite.

Julie C. Yang

JCY:mlr

Attachments

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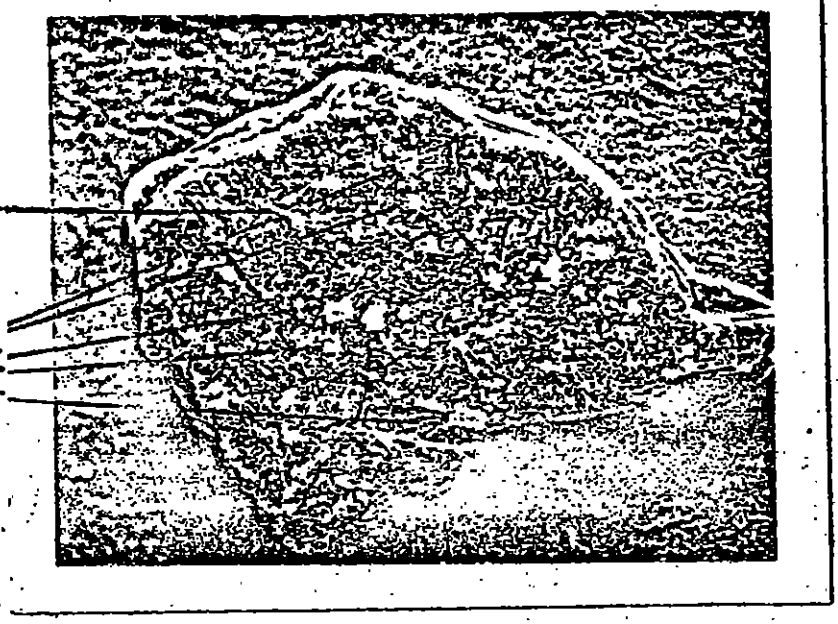
Figure 1 MICROSCOPIC EXAMINATION OF VERMICULITE SURFACES



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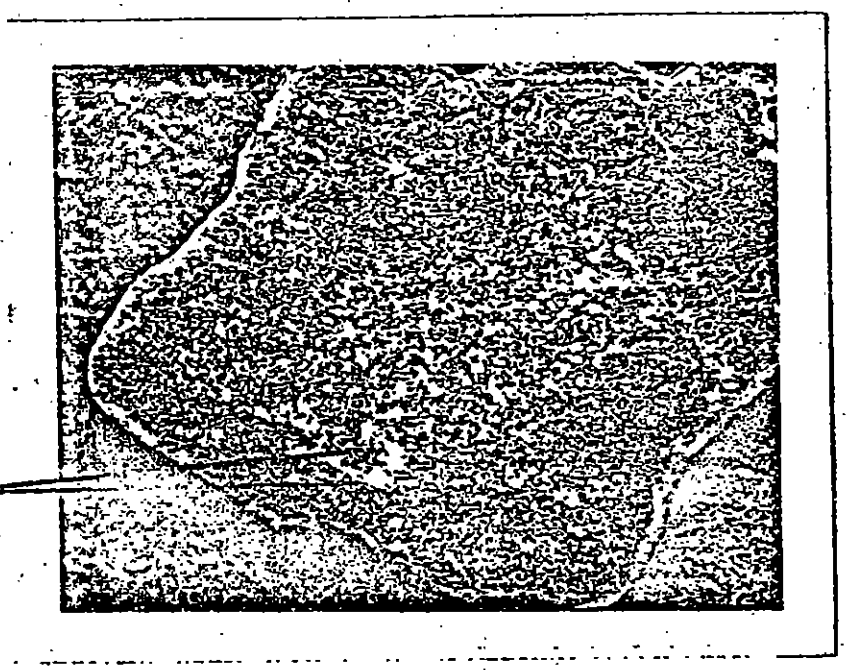
a, Libby # 2 Vermiculite plate as Received



b, An "Polished" Libby # 2 Vermiculite Plate

(50 x)

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Fig. 2 AIR ELUTRIATION COLUMN FOR VERMICULITE SEPARATION

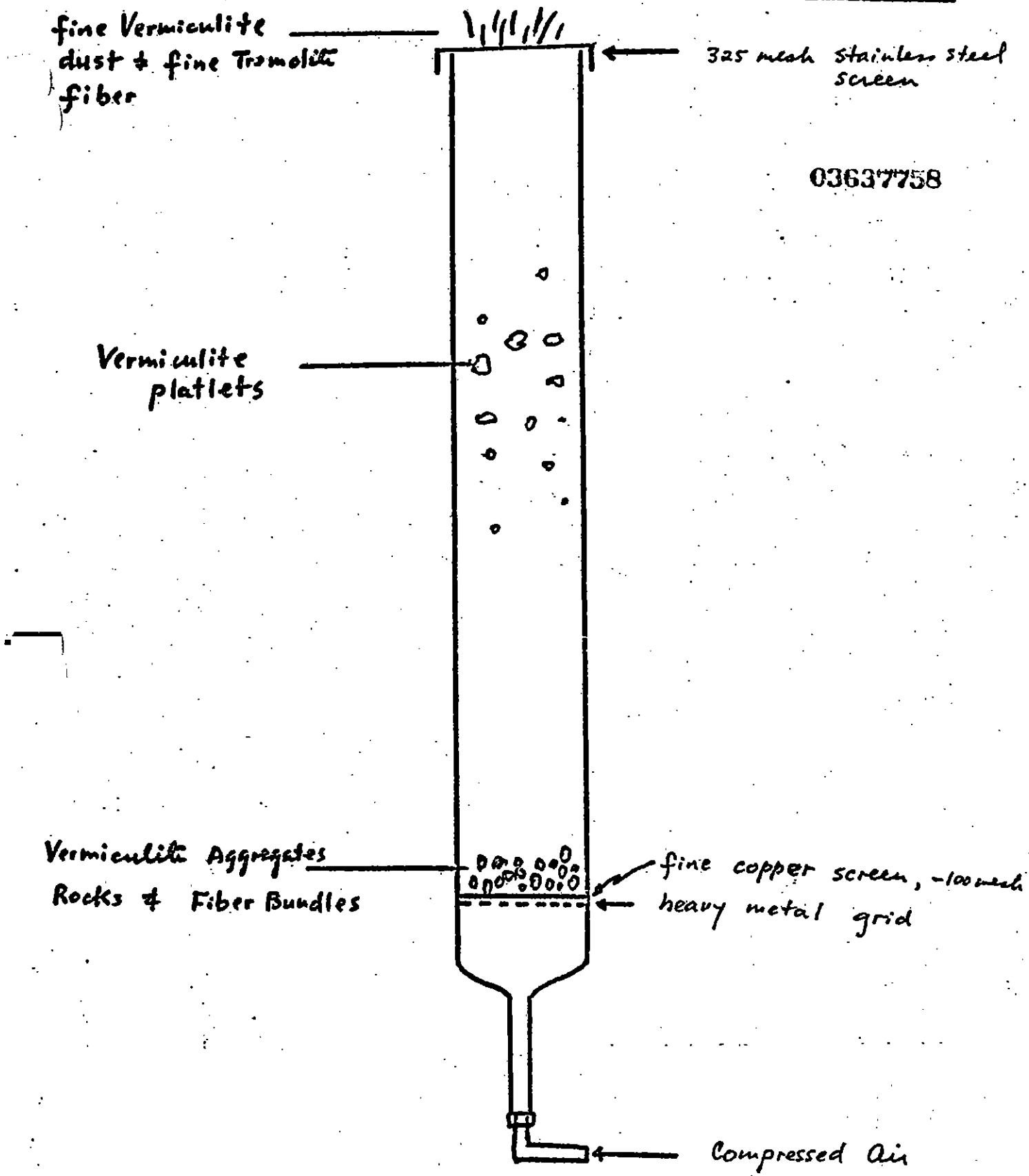

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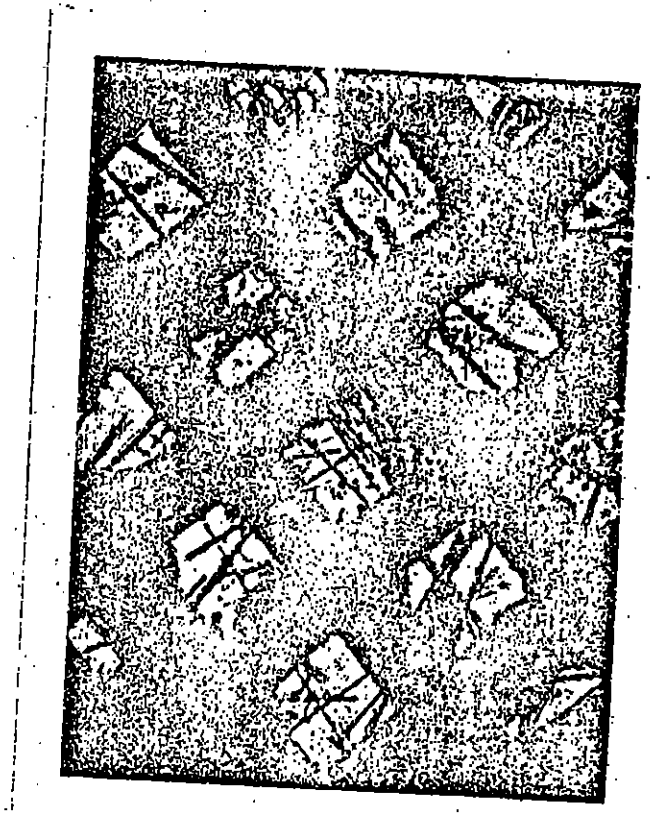
Fig. 3 Vermiculite Dust and Tremolite Fibers Collected from the Top of Air Elutriation Column

Material : Libby #2 Composite

(300X)

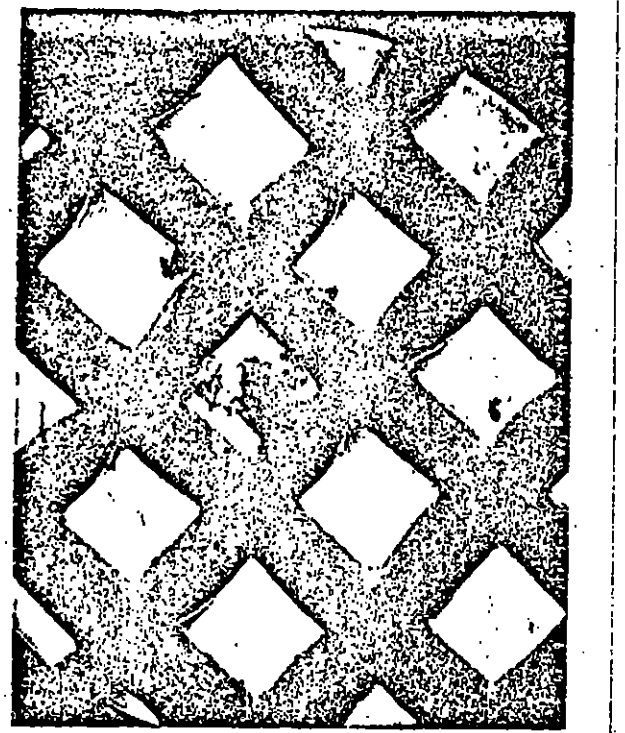


(300X)

black grating : 325 mesh screen

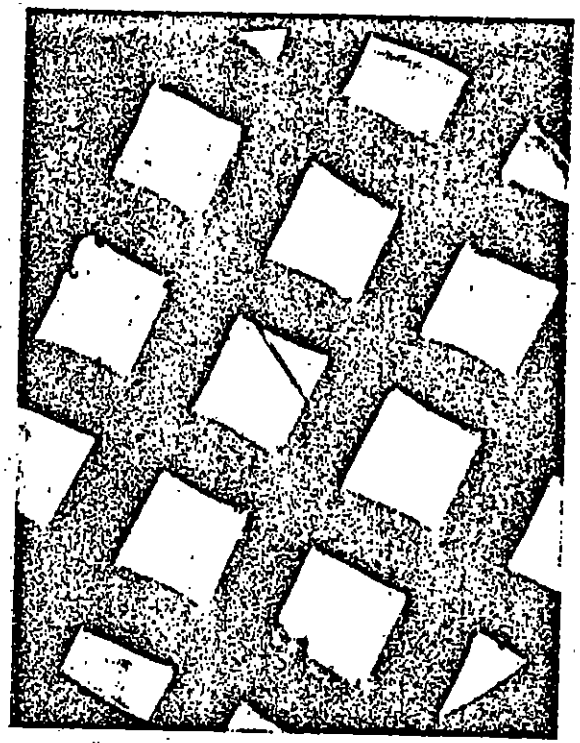
g. 4 Vermiculite Dust and Tremolite Fibers Collected from the Top of Air Elutriation Column (2)

Material : Vermiculite Portion from Column (1)



(300x)

a) Typical Field



(300X)

b) Selected Field

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